Exhibit D

MPSC
Michigan Public Service Commission

Michigan Statewide Energy Assessment

Final Report

September 11, 2019

Sally A. Talberg, Chairman
Daniel C. Scripps, Commissioner
Tremaine L. Phillips, Commissioner

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and/or rapidly recover from a potentially disruptive event."[24] Similarly, NARUC defines resilience as "the robustness and recovery characteristics of utility infrastructure and operations, which avoid or minimize interruptions of service during an extraordinary and hazardous event."[25]

Investments targeting increased reliability and resilience must consider all factors in order to cost-effectively plan for a wide range of threats. A document released by Grid Strategies LLC in May 2018 described the need for multi-threat planning related to electric system resilience:

> *From a customer-centric perspective, the most cost-effective measures to advance reliability and resilience are those that are effective against multiple threats and offer multiple benefits in addition to their merits for reliability and resilience. Such high-value measures include those that reduce distribution-level outages (e.g., tree-trimming and distribution automation systems), improve outage recoverability (e.g., emergency management drills, outage management systems, critical spares and mutual assistance programs), and improve customer survivability (e.g., energy efficient building shells, emergency supplies and distributed generation and storage with smart inverters).*[26]

Michigan stakeholders and the utilities would be well served to keep abreast of developments occurring across the U.S. to facilitate resiliency improvements to the electric system. The following sections provide additional detail on the current energy landscape in Michigan and describe areas which may impact the prioritization of investments to enhance reliability and resilience.

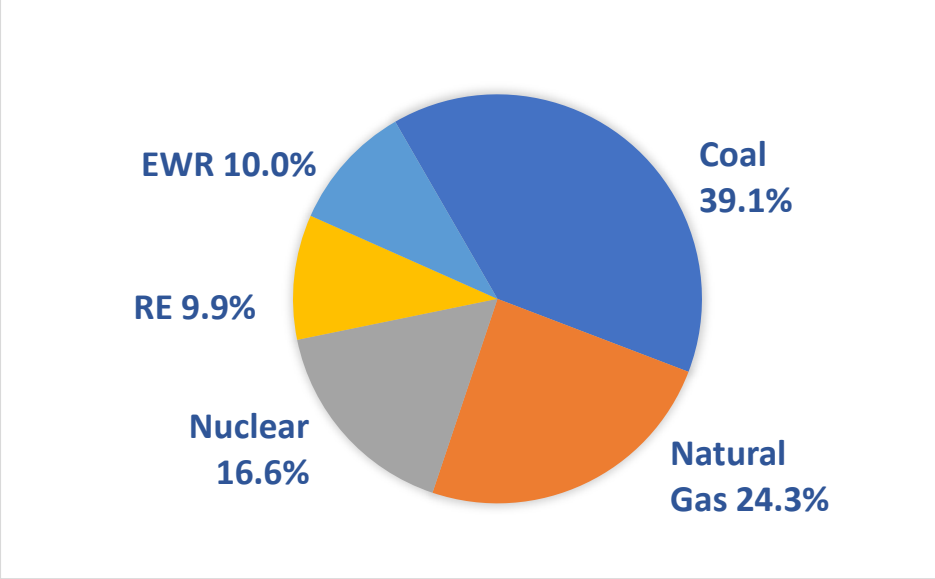
2.3.1 Fuel Procurement and Gas Supply Availability

2.3.1.1 Generation Diversity and Interdependencies - Michigan's electric generation fleet is evolving as aging coal plants are retired at an accelerated pace and replaced with natural-gas fueled electric generation, renewable energy, and energy efficiency. In Michigan, where natural gas is used to heat the homes of more than 75% of the residents, there is an inherent interdependency between natural gas used for electric generation and for home heating. For the time being, while natural gas supplies from the eastern shale and other producing regions in the nation are plentiful and accessible, Michigan is buffered from price swings in the market due to shortage conditions (although there have been localized, short-term price spikes due to pipeline outages during cold weather conditions). Disruptions to

[24] https://www.raponline.org/wp-content/uploads/2019/08/rap_shenot_linvill_dupuy_combinations_pv_other_ders_2019_august.pdf, p. 34.
[25] https://pubs.naruc.org/pub/531AD059-9CC0-BAF6-127B-99BCB5F02198, p. 7.
[26] Source: https://gridprogress.files.wordpress.com/2018/05/customer-focused-resilience-final-050118.pdf, p. 13.

transmission facilities, and the effective deployment of emerging technologies such as energy storage.[30]

Figure 2-10 2017 Status Toward Reaching the PA 342 35% by 2025 Goal



Source: MPSC
Note: EWR means energy waste reduction and is synonymous with energy efficiency. RE means renewable energy. Nuclear output does not include portions of the DC Cook plant serving Indiana load.

Energy efficiency, while often overlooked in the discussion of resilience improvements, plays a vital role. Resilience is needed for critical operations to continue while the grid may be down, however, taking steps to ensure that critical loads are as efficient as possible is a key resilience improvement.

Legislated Clean Energy Targets:

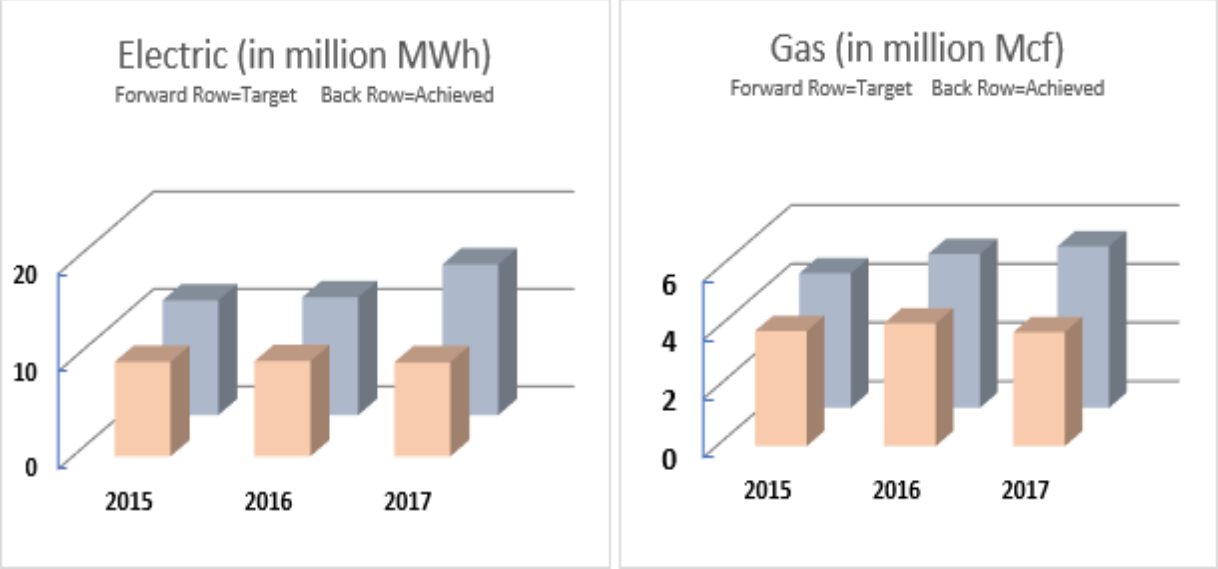
- The **Renewable Energy Program** has required electric utilities to meet a 10% renewable energy standard, based on the number of Renewable Energy Credits (RECs), since 2015. The standard has an interim requirement of at least 12.5% for 2019 and 2020 and increases to at least 15% by the end of 2021. To date, the RE standard has led to the development of over 1,714 MW of new RE projects. Additional amounts of renewable

[30] MISO is reviewing challenges and opportunities associated with integrating higher amounts of renewable energy on its system in its "Renewable Energy Integration Impact Assessment." https://cdn.misoenergy.org/20181128%20RIIA%20Workshop%20Presentation295441.pdf.

energy continue to be proposed based on economics even with the federal tax credits stepping down in the near term.

- **Electric and Natural Gas Efficiency Programs** decrease the amount of energy needed and play a unique role in energy supply diversity. Legislative targets reflect a 1.0% reduction and a 0.75% reduction per year in retail electric and natural gas sales respectively; however, recent utility IRPs call for increased electric energy savings of 1.5% or more. Electric and natural gas utilities have continued to cost effectively meet or exceed targets year over year based on verified savings reviewed by the Commission and an independent third-party evaluation.[31] Figure 2-11 shows projected versus actual electric and natural gas energy savings achieved from 2015 through 2017.

Figure 2-11 Michigan's Electric & Gas Savings Targets vs Savings Achieved 2015-2017



Source: MPSC

Non-Legislated Efficiency Programs

- **Electric Demand Response Programs** incentivize customers with pricing discounts to use less energy during peak times or during system emergencies. The Commission recognizes DR as an integral part of a utility's energy portfolio and recently created a DR

[31] 2017 Annual Report on Energy Efficiency: https://www.michigan.gov/documents/mpsc/2017_Energy_Waste_Reduction_Report_to_the_Legislature_Final_646391_7.pdf, p. 3.

framework structured similarly to the process used for EWR programs. The first cases are ongoing.

- **Natural Gas Demand Response Programs** are not common compared to electric DR programs, but the concept has gained national legislative attention with an eye toward improving electric and gas system reliability.[32] Michigan's gas utilities do not currently have DR programs. This report identifies natural gas DR as an opportunity for the future as it could have avoided the need for a broad public appeal during PV19.
- **Natural Gas Pipeline Leak Mitigation** provides natural gas efficiency improvements by decreasing leaks and has been a feature of natural gas utility infrastructure Investment Recovery Mechanisms (IRM) since 2011/2012. The IRM was designed to accelerate the removal of high-risk pipelines, decrease the backlog of natural gas pipeline leaks, improve the integrity of the natural gas transmission and distribution systems, and reduce the need for annual rate cases. This reduction in natural gas rate cases is notable for SEMCO, MGU, and DTE Gas. Figure 2-12 is a compilation of corrosion-related leak mitigation, since 2010. The baseline year (pre-IRM) is 2010.[33]

[32] 1. Senator Sheldon Whitehouse (D-RI) sponsored a bill to "establish a natural gas demand response pilot program to use the latest demand response technology from the energy sector for natural gas." Energy Infrastructure Demand Response Act of 2018, S. 2649, 115th Congress (introduced Apr. 11, 2018). 2. A required Department of Energy (DOE) study will address "the costs and benefits associated with those savings, including avoided energy costs, reduced market price volatility, improved electric and gas system reliability, deferred or avoided pipeline or utility capital investment, and air emissions reductions." Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, H.R. 5895, 115th Congress (Sept. 21, 2018). Source: American Bar Association, www.americanbar.org, March 1, 2019. By Laura Olive.

[33] Note: The number of leaks repaired increased drastically from 2011 to 2012. This is due in part to operators repairing the backlog of leaks that were on their system at a faster rate. After seven complete years of accelerated main replacement programs, corrosion leaks repaired in 2018 dipped to a level lower than they were in 2010 before the accelerated programs were implemented. Leak-prone material types continue to deteriorate and leak at an increasing rate, and the impact of harsh winter conditions (frost) increase the number of leaks. Remediation planning is keeping more identified leaks in a backlog for CE (e.g. 2010: 780 vs. 2018: 3916).

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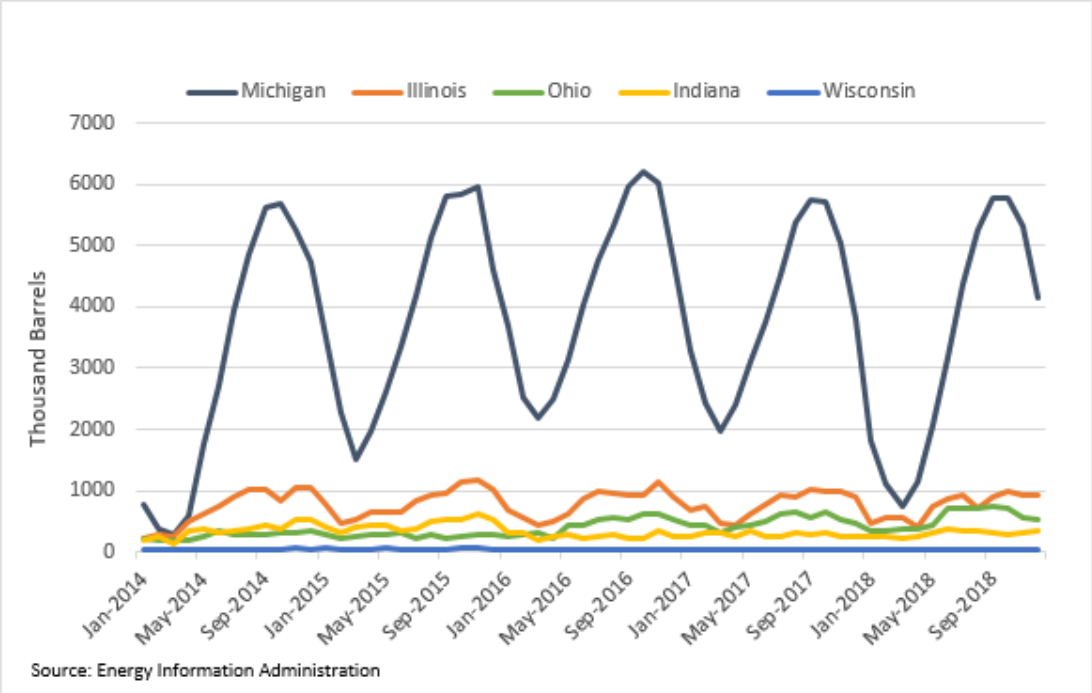
Figure 5-2 Bulk Storage, Natural Gas Plant, and Refinery Propane Stocks



5.3.2 Infrastructure

Michigan's two fractionators play an important role in meeting in-state, and to some extent, out-of-state propane demand. One fractionator is located in Rapid River in the Upper Peninsula and receives supplies of NGLs from Line 5 of Enbridge's Lakehead Pipeline System. The Rapid River fractionator produces approximately 2,000 bpd[129] of propane, and with its associated storage capacity, is an important source of propane for the residents of the Upper Peninsula and Wisconsin who rely on propane. Additionally, Line 5 also supplies a fractionator and several refineries in Sarnia, Ontario. This Sarnia fractionator is the largest in eastern Canada and has a fractionation capacity of 120,000 bpd,[130] producing primarily propane and butanes, some of

[129] MPSC Staff calculation from Dynamic Risk's "*Alternatives Analysis for the Straits Pipelines*", Appendix: Tables C-1 and C-2. https://mipetroleumpipelines.com/files/user/documents/AlternativesAnalysisFinal-Appendices.pdf.

[130] Canadian Energy Research Institute (CERI), https://ceri.ca/assets/files/CERI%20Study%20139%20Part%20II%20-%20Final.pdf. Note: Assuming an overall plant capacity factor of 95% and a similar NGL input stream as to what is received in Rapid River, Staff estimates average daily propane production would be approximately 78,660 bpd (3,303,720 gallons).

which is transported by truck, rail, or pipeline to storage facilities and eventually to consumers in Michigan. In order for these fractionators to continue accessing NGLs from Line 5, the pipeline must operate as an integrated whole.

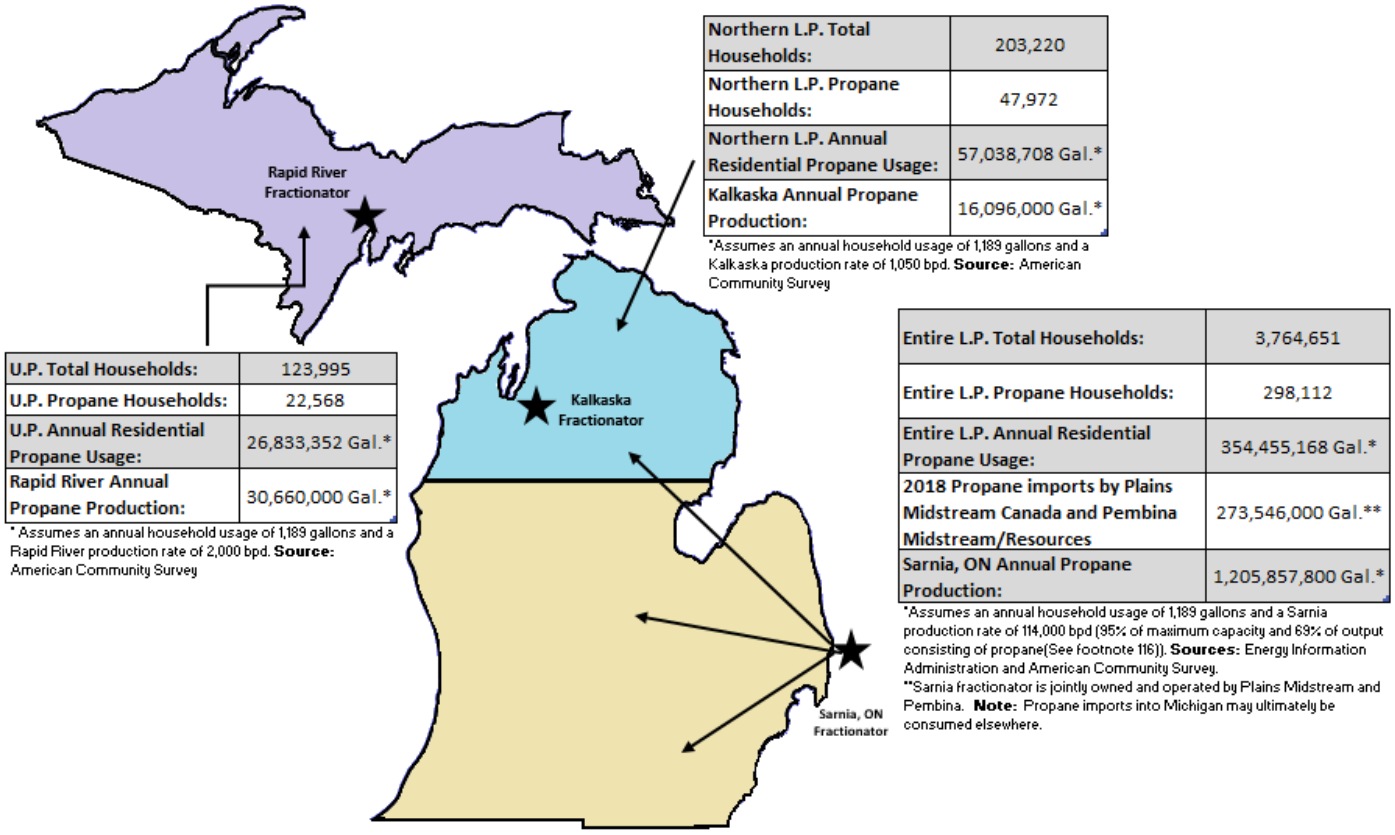
Michigan's second fractionator is near Kalkaska in the northern Lower Peninsula and receives its feedstocks primarily by pipeline from natural gas production facilities in the area, but also by rail from out-of-state sources, and by truck from in-state oil production operations. On average, this fractionation facility produces 1,050 bpd of propane, supplying approximately 28 retail propane providers with operations in Michigan. The northern Lower Peninsula is an area of the state that relies heavily on propane for household heating, placing the facility in a strategic location. Annual production from the Kalkaska fractionator is equivalent to 28% of northern Lower Peninsula demand,[131] defined as the region shaded in blue below.

In addition to the fractionators in Michigan, Marathon's Detroit Refinery also produces propane as a byproduct of its operations, estimated by MPSC Staff to be approximately 2,300 bpd.[132] One significant source of crude oil for the refinery is Line 78 of the Lakehead Pipeline System connecting Pontiac, Illinois to Sarnia, Ontario.

[131] Assumes an annual household usage of 1,189 gallons.

[132] According to Marathon Petroleum Corporation's (MPC) 2018 Securities and Exchange Commission (SEC) 10-K filling, Mid-Continent refinery yields of propane were 14,000 bpd from the processing of 839,000 bpd of crude oil, equating to a 1.66% average propane refinery yield rate. MPC's Detroit Refinery has the capacity to refine 140,000 bpd of crude oil. Applying the Mid-Continent average propane refinery yield rate to MPC's Detroit Refinery capacity equates to 2,324 bpd of propane production.

Figure 5-3 Fractionators Located in Michigan



Northern L.P. Total Households:	203,220
Northern L.P. Propane Households:	47,972
Northern L.P. Annual Residential Propane Usage:	57,038,708 Gal.*
Kalkaska Annual Propane Production:	16,096,000 Gal.*

*Assumes an annual household usage of 1,189 gallons and a Kalkaska production rate of 1,050 bpd. **Source:** American Community Survey

U.P. Total Households:	123,995
U.P. Propane Households:	22,568
U.P. Annual Residential Propane Usage:	26,833,352 Gal.*
Rapid River Annual Propane Production:	30,660,000 Gal.*

* Assumes an annual household usage of 1,189 gallons and a Rapid River production rate of 2,000 bpd. **Source:** American Community Survey

Entire L.P. Total Households:	3,764,651
Entire L.P. Propane Households:	298,112
Entire L.P. Annual Residential Propane Usage:	354,455,168 Gal.*
2018 Propane imports by Plains Midstream Canada and Pembina Midstream/Resources	273,546,000 Gal.**
Sarnia, ON Annual Propane Production:	1,205,857,800 Gal.*

*Assumes an annual household usage of 1,189 gallons and a Sarnia production rate of 114,000 bpd (95% of maximum capacity and 69% of output consisting of propane(See footnote 116)). **Sources:** Energy Information Administration and American Community Survey.
Sarnia fractionator is jointly owned and operated by Plains Midstream and Pembina. **Note: Propane imports into Michigan may ultimately be consumed elsewhere.

5.3.3 Market Access Diversity

Michigan's central location relative to various supply sources creates a resilience advantage when compared to other states, particularly along the East Coast, where supplemental shipments often must arrive from overseas. NGLs, the raw material for propane, can be accessed via pipeline, and consumer grade propane can be transported into Michigan by rail from several different locations including western Canada, Chicago, Toledo, as well as Sarnia and Windsor, Ontario. Transporting propane by truck is common from these locations (excluding western Canada), but also provides the option to source product from the TEPPCO Pipeline (originating near the Gulf Coast) at points in Indiana and Ohio. This diverse access to consumer grade propane helps to provide energy security and can help alleviate price spikes during periods of high demand.

5.3.4 Market Size

Michigan ranks first in the nation for residential propane usage by volume, followed by neighboring states Minnesota and Wisconsin. Although states such as Vermont, South Dakota, and New Hampshire have a higher proportion of households utilizing propane for primary home heating, Michigan's large population relative to these states requires a more robust propane

infrastructure system to handle greater consumption volumes. Below in Figure 5-4 is a propane market size comparison between various propane consuming states.

Figure 5-4 State Propane Market Sizes, 2017

	Percent of Households	Number of Households	Total Residential Consumption (Gallons)	Average Household Consumption (Gallons)
Michigan	8.2%	320,680	381,444,000	1,189
Illinois	4.1%	198,002	198,156,000	1,000
Ohio	5.2%	241,227	187,950,000	779
Indiana	7.1%	180,475	117,684,000	652
Wisconsin	11.2%	260,306	243,600,000	935
Vermont	15.8%	40,879	70,266,000	1,718
South Dakota	15.6%	53,053	44,268,000	834
New Hampshire	15.4%	81,344	105,000,000	1,290

Sources: Energy Information Administration and U.S. Census Bureau - American Community Survey.
Note: Residential consumption includes all forms of consumption and is not limited to home heating. Although residential propane usage is primarily for home heating, average consumption statistics are likely inflated due to uses other than for home heating (clothing dryers, water heating, pool heating, etc.)

5.4 Vulnerabilities

As is the case for all energy systems, Michigan's propane energy system can be susceptible to vulnerabilities that could disrupt the availability and reliability of supplies for consumers. Awareness and understanding of these vulnerabilities are paramount to contingency planning and ultimately the response to an energy emergency event. As part of the efforts to develop this assessment, Staff developed and conducted an anonymous survey to propane industry partners to better understand the system and potential vulnerabilities. The results of the survey, consisting of 20 questions, were incorporated into this report and a summary of key findings is included as Appendix G.

5.4.1 Driver Shortages

One of the primary methods in which propane is moved from large storage hubs to retail locations is by transport truck. Industries across the U.S. that rely on truck transports are finding it difficult to maintain an adequate amount of truck drivers. According to a report by the American Transportation Research Institute, driver shortages ranked as the trucking industry's top concern in 2018, and the U.S. driver shortage was estimated to be over 50,000.[133] Michigan's propane industry is vulnerable to this shortage during the winter when the demand for propane increases. In the survey of Michigan propane retailers, 28% of respondents indicated that they had experienced difficulty in receiving or distributing propane due to the availability of properly trained and qualified transport drivers. However, 67% of respondents had a moderate concern and 22% had a major concern regarding the availability of properly trained and qualified transport drivers.

5.4.2 Infrastructure Availability

Although Michigan is fortunate to have a significant amount of propane storage capacity and two in-state fractionators, the availability of heavily relied upon infrastructure is still a vulnerability to the propane energy system. If given enough time and advanced notice, open markets can and will adjust to create an alternative economic solution to meet consumer demand. However, when key pieces of infrastructure are suddenly taken off-line, such as a catastrophic equipment failure, prices will often become volatile until the market has an adequate amount of time to adjust. For example, if a sudden loss of Line 5 (which supplies multiple refineries and fractionators) or DTE's northern Michigan "wet header" (which supplies feedstock to the Kalkaska fractionator) experienced a major outage without advance planning, the system would require significant changes to replace those supply sources. At least in the short term, these alternate sources and transportation methods are likely to be less reliable and more costly. In the long-term, migrating away from pipeline supply will remove a layer of redundancy to the system, thus decreasing our resilience to future supply issues or infrastructure outages.

A sudden failure of Line 5 without warning to arrange alternative supplies and delivery could have widespread implications, starting with the loss of NGL supply to the Rapid River and Sarnia fractionators. Enbridge has stated that Line 5 serves approximately 55 percent of Michigan's propane needs and about 65 percent of the U.P. and northern Michigan's propane needs. Rapid

[133] American Transportation Research Institute, "Critical Issues in the Trucking Industry - 2018". https://atri-online.org/wp-content/uploads/2018/10/ATRI-Top-Industry-Issues-2018.pdf.

River has no other available short-term supply options and without identifying an alternative source for NGLs, would essentially become a stranded asset. The Sarnia fractionator, given its relative size and location, may have the opportunity to secure additional NGL supply by rail or alternative pipelines. However, it is unclear whether this additional rail or pipeline capacity is available to supplant volumes lost from Line 5. Without the Rapid River propane fractionator operating in the U.P., trucking would likely be used as the next alternative. Truck transports would have to travel further distances either downstate, or out of state to locations like Superior or Janesville, WI. Southern Michigan is fortunate to have an abundance of underground storage capacity, which may help to insulate supply disruptions for a short period of time. However, without the flow of propane from the Sarnia fractionator, this supply would be depleted within one winter season. As a result, lines and wait times at terminals would likely increase, forcing distributors in the Lower Peninsula to travel further distances for supplies. During the PV14, it was not uncommon for trucks to travel as far as Kansas or the Gulf Coast for supplies of propane.

The most recent supply shock to Michigan's propane energy system was in 2014, with the combination of a wet drying season that depleted propane reserves, the polar vortex, the reversal of the Cochin pipeline, and sudden loss of fractionator feedstock at Rapid River. Residential propane prices to begin the 2013/14 heating season averaged $2.06/gallon, but later peaked at $3.76/gallon the first week of February as supplies became tight.

5.4.3 Exports

U.S. propane exports have increased considerably in the past decade – primarily from the Gulf Coast and to a lesser extent the East Coast. Gulf Coast exports of propane for the month of December 2018 averaged 998 thousand bpd compared to only 23 thousand bpd in December 2008. Top destinations for propane leaving the Gulf Coast in 2018 included Japan, China, and Mexico. An increase in drilling activity and infrastructure buildout in the Appalachian Basin has also made more propane available for export from the East Coast, rising from nearly zero in 2008 to an average of 59 thousand bpd in 2018.